METHOD OF FABRICATING A STRETCHABLE COMPUTING DEVICE

TECHNICAL FIELD

[0001] Embodiments described herein generally relate to a computing device, and more particularly to a method of fabricating a stretchable computing device.

BACKGROUND

[0002] Conventional manufacturing techniques typically suffer from the problem associated with only utilizing one layer for electronic traces. Utilizing one layer for electronic traces is severely limiting in terms of the complexity of a circuit that may be designed into a stretchable computing device. Many existing electronic packages and boards utilize multiple layers in order to more densely pack electronic devices into a smaller X-Y electronic package.

[0003] Some textile manufacturers are experimenting with crocheting and knitting conductive yarn into more than one layer of conductive fabric, but this technique results in an electronic fabric that is difficult to encapsulate or weather-proof. In addition, the electronic yarn and thread suffer from fibers that break easily thus degrading electronic signals very quickly.

[0004] Therefore, a need exists for a method of fabricating a stretchable computing device that may integrate various sensors, power supplies and electronic packages. Stretchable computing devices may enable various approaches to managing different types of applications (e.g., wearable applications) where computing power may be utilized to enhance the application.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] FIG. **1** is a schematic view illustrating an example pillar that has been soldered on to a conductive layer.

[0006] FIG. **2** is a schematic view illustrating an example conductor that has been fabricated to form a pillar onto a conductive layer.

[0007] FIGS. **3**A-**3**H show schematic views of an example method of fabricating a stretchable computing device.

[0008] FIGS. **4**A-**4**I show schematic views of another example method of fabricating a stretchable computing device.

[0009] FIGS. **5**A-**5**I show schematic views of still another example method of fabricating a stretchable computing device.

[0010] FIG. **6** is block diagram of an electronic apparatus that includes the electronic assemblies and/or the electronic packages described herein.

DESCRIPTION OF EMBODIMENTS

[0011] The following description and the drawings sufficiently illustrate specific embodiments to enable those skilled in the art to practice them. Other embodiments may incorporate structural, logical, electrical, process, and other changes. Portions and features of some embodiments may be included in, or substituted for, those of other embodiments. Embodiments set forth in the claims encompass all available equivalents of those claims.

[0012] Orientation terminology, such as "horizontal," as used in this application is defined with respect to a plane parallel to the conventional plane or surface of a wafer or substrate, regardless of the orientation of the wafer or substrate. The term "vertical" refers to a direction perpendicular to the horizontal as defined above. Prepositions, such as "on," "side" (as in "sidewall"), "higher," "lower," "over," and "under" are defined with respect to the conventional plane or surface being on the top surface of the wafer or substrate, regardless of the orientation of the wafer or substrate.

[0013] The example methods and stretchable computing systems described herein may include a variety of electronics. Some examples include a power supply and/or a communication device (among other types of electronics).

[0014] In some forms, the example stretchable computing systems may be integrated with (or attached to) textiles (i.e. clothing) (see FIGS. **3**H, **4**I, **5**I). In other forms, the example stretchable computing systems may be attached directly to the skin of someone (i.e., similar to a bandage) that utilizes any of the example stretchable computing systems described herein.

[0015] As used herein "stretchable" refers to the ability elongate in the direction of an applied force. The amount of stretching will be determined in part based on the application where any of the example methods described herein are to be used. As an example, the degree of stretching may be different when the example stretchable computing devices described herein are integrated with (or detachably connected to) textiles (e.g., clothing) as opposed when the example stretchable computing devices described herein are attached directly to the skin of someone that utilizes any of the example stretchable computing systems.

[0016] The example methods described herein may create multi-layered electronics by integrating vias to connect multiple layers of electronic traces within a stretchable member (which may be subsequently integrated into textiles).

[0017] FIGS. **3**A-**3**H show schematic views of an example method of fabricating a stretchable computing device **30**. The method includes attaching a first set of conductive traces **31** to a stretchable member **32** and attaching a first electronic component **33** and a conductive pillar **34** to the first set of conductive traces **31** (see FIG. **1** and FIGS. **3**A-**3**C).

[0018] The method further includes adding a first set of flexible conductors **35** to the stretchable member **32** such that the first set of flexible conductors **35** are electrically connected to the first set of conductive traces **31** (see FIG. **3**C). The method further includes adding stretchable material **36** to the stretchable member **32** such that the first set of conductive traces **31** and the conductive pillar **34** are at least partially surrounded by the stretchable member **32** (see FIG. **3**D), and attaching a second set of conductive traces **37** to the stretchable member **32** such that the second set of conductive traces **37** is electrically connected to the conductive pillar **34** (see FIG. **3**E). The method further includes attaching a second electronic component **38** to the second set of conductive traces **37** (see FIG. **3**F), and adding a second set of flexible conductors **39** to the stretchable member **32** such that the second set of flexible conductors **39** are electrically connected to the second set of conductive traces **37** (see FIG. **3**F).

[0019] In some forms, the stretchable member **32** may be an elastomer. It should be noted that the stretchable member may be any material that is stretchable in one or more directions. The type of material that is utilized in the method